

*Occultation Studies of the Solar System*

Lowell Observatory  
1400 West Mars Hill Road  
Flagstaff, Arizona 86001

**Robert L. Millis**

***Strategy***

Occultations of stars by planets, satellites, planetary ring systems, and asteroids offer opportunities to study the occulting bodies in ways not otherwise possible from the surface of the Earth. For example, one can detect even an extremely tenuous atmosphere and can measure the temperature and density profiles of the atmosphere in regions not ordinarily sampled by spacecraft. Occultations also permit direct measurement of the size and shape of solar system objects too small to be directly resolved by groundbased telescopes. The accuracy of such determinations is typically 1%-2% and, moreover, is independent of the distance to the object. In this investigation, we identify upcoming occultations through wide-ranging computer searches, provide accurate predictions for the more important events, and observe selected occultations with our specially designed portable photometric equipment.

***Progress and Accomplishments***

During the past year, we continued analysis of the data from the 9 June 1988 occultation of P8 by Pluto. The thrust of this investigation, undertaken jointly with James Elliot at MIT, is to derive the structure and extent of Pluto's atmosphere from a simultaneous fit to observations from eight different sites. After much experimentation with a numerical approach to this problem, an analytic technique has been developed and good progress made toward finishing the work. This effort can be expected to yield the best possible values of the ratio of temperature to mean molecular weight in the atmosphere and of the radius of the top of the postulated haze layer or steep thermal gradient. Also, during the year we provided refined predictions for occultations by Triton, Kleopatra, and Vesta. Unfortunately, our efforts to observe the Kleopatra event were foiled by widespread cloudiness.

***Projected Accomplishments***

Next year we plan observations of occultations by Vesta, Kleopatra, Ceres, and possibly Pallas and Triton. The analysis of the global properties of Pluto's atmosphere will be completed and the results published. A comprehensive computerized catalog search for occultation of stars by asteroids and satellites will be completed and predictions for events occurring in 1992 and 1993 will be published. We also plan a concerted astrometric effort in collaboration with colleagues at the U.S. Naval Observatory aimed at providing accurate predictions for possible upcoming occultations by Pluto and Triton.

## ***Publications***

Dunham, D.W., and 45 other authors including Wasserman, L.H., Bowell, E., and Nye, R.A. of Lowell Observatory. The Size and Shape of (2) Pallas from the 1983 Occultation of 1 Vulpeculae. *Astron. J.* **99**, 1636, 1990.

Hubbard, W.B., Hunten, D.M., Reitsemä, H.J., Brosch, N., Nevo, Y., Carreira, E., Rossi, R., and Wasserman, L.H. Results for Titan's Atmosphere from Its Occultation of 28 Sagittarii. *Nature* **343**, 353, 1990.

Lebofsky, L.A., Hubbard, W.B., Asphang, E., Hunten, D.M., Millis, R.L., Franz, O.G., and Wasserman, L.H., A'Hearn, M., Schnurr, R., Klemola, A.R., Osborn, W., Vilas, F., Potter, A.E., Maley, P.D., and Manly, P.L. Diameter, Rotation, and Thermal Properties of Asteroid 4 Vesta. *Bull. Amer. Astron. Soc.* **22**, 1112, 1990.

Wasserman, L.H. No Occultation of SAO 187435 by Triton. *IAU Circ.* No. 5058, 1990.